



Apparatus for Combined Static and Dynamic Uniaxial Stress

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result in a brighter image. In this system, a larger mirror resulted in a blurred image due to multiple reflections.

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¹ M. Bodenstein and W. Dux, *Z. Phys. Chem. (Leipzig)* **85**, 297 (1913).

² S. G. Yorke, *J. Sci. Instr.* **22**, 196 (1945).

Small Conductor Vacuum Feedthrough*

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(Received 29 May 1967)

A FITTING of Swagelok¹ type has been used to make a high vacuum feedthrough for small conductors. A cross section drawing is shown in Fig. 1. The seal is made by compressing an insert of Teflon² plastic, fitted into the Swagelok fitting, onto the wire or rod which forms the conductor of the feedthrough. The insert is machined to fit snugly into the Swagelok fitting. A hole is drilled through the insert to accommodate the conductor. This hole is drilled only large enough to allow minimum clearance for the passage of the conductor. When the conductor is in place, the Swagelok is tightened on the Teflon insert, as recommended by the manufacturer. This compresses the insert between the fitting and the conductor, thus forming the seal.

The Swagelok fitting can be mounted on any style and any size flange. Mounting can be done by any means appropriate to good vacuum technique. The feedthroughs made in our Laboratory were mounted on blank shear seal flanges which were drilled and threaded to receive the threads of the fittings. Teflon tape was used on the threads to provide a vacuum seal. Nonthreaded fittings could be used by welding or hard soldering them to the flange.

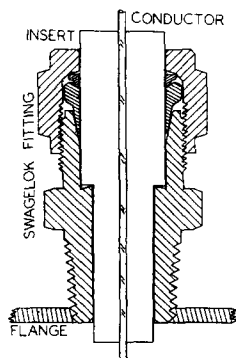


FIG. 1. Cross section of the feedthrough.

Feedthroughs of this type have been found to be very useful for providing entrance of thermocouples into vacuum chambers and have been used with vacuum in the 10^{-8} Torr range. In most cases, 0.76 mm wire has been used, but reliable seals have been made with smaller or larger single strand wire. Braided wire made unreliable seals.

* Work performed under USAEC Contract No. AT(29-1)-1106.

¹ Swagelok is a registered trademark of the Crawford Fitting Co., 29500 Solon Rd., Solon, Ohio.

² Teflon is a registered trademark of E. I. duPont de Nemours & Co.

Apparatus for Combined Static and Dynamic Uniaxial Stress

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THE remarkable sensitivity of optical measurements on dynamically strained crystals was demonstrated independently by Gobeli and Kane¹ and by Engeler *et al.*² These authors used techniques without the possibility of superimposing a static component of the stress. This letter reports on an apparatus for combined static and dynamic uniaxial stress. Piezo-optical measurements with this setup have been reported.^{3,4}

The design is based on a previously described apparatus⁵ for static compressive stress modified to permit magnetic generation of a sinusoidally modulated force. Figure 1 shows the modified stressing frame. The sample with dimensions approximately $1 \times 1 \times 15$ mm is cemented into two rods, the upper rod being fixed and the lower guided by four bronze blade springs that assure negligible friction. These blades replace the piston formerly used.⁵ The

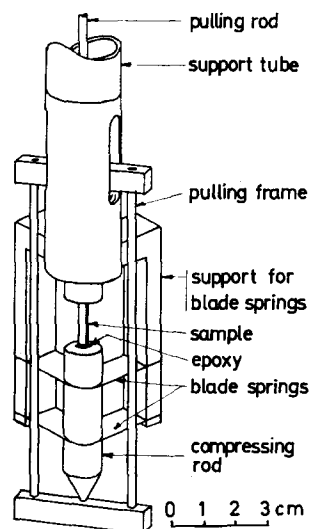


FIG. 1. Strain apparatus for compressive uniaxial stress with negligible friction in guiding arrangement. The two orthogonal pairs of blade springs are made of 0.3 mm bronze.

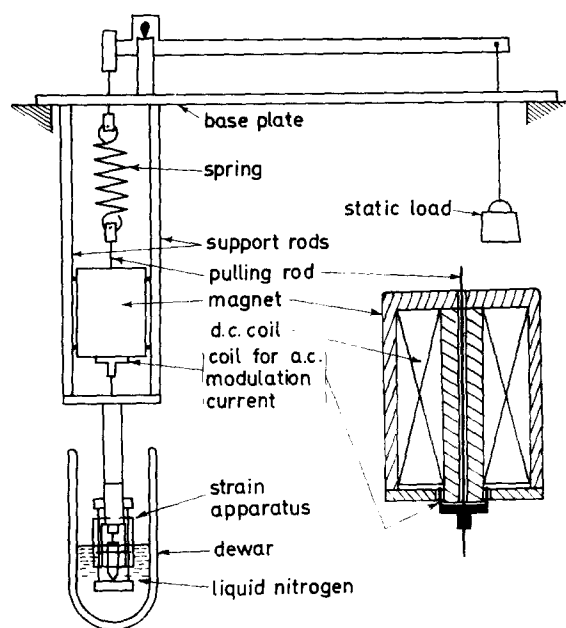


FIG. 2. Load arrangement for application of combined static and dynamic force to the pulling rod.

lower compressing rod is pulled upwards by a frame and a pulling rod. In Fig. 2 is shown the arrangement for applying a combined static and dynamic force. The magnet gives a constant, radial magnetic field in an annular volume as in a loudspeaker, and the force modulation coil for ac is rigidly connected to the pulling rod. The static load is transferred to this rod through a heavy spring preventing an oscillatory motion of load and arm.

Typical data of operation are static force 0 to 100 kgf, dynamic force 0 to 5 kgf peak to peak, and modulation frequency 70 cps.

The apparatus may be operated at liquid nitrogen temperatures as indicated in Fig. 2. Temperatures of the sample very close to 77°K were obtained by means of a container with liquid nitrogen (not shown) soldered to the cylindrical piece between support tube and sample (see Fig. 1).

The technique reported here may be useful in investigations of any piezo-effect (electrical or optical) where a differential modulation of the stress is desired. Such situations arise if the change due to stress of an observable quantity is smaller than the long term stability of the experimental setup, but larger than the fundamental noise (e.g., dark noise of the detector in optical measurements).

Thanks are due to T. Guldbrandsen and I. Trabjerg for valuable discussions.

* On leave of absence at Bell Telephone Laboratories, Murray Hill, New Jersey.

¹ G. W. Gobeli and E. O. Kane, *Phys. Rev. Letters* **15**, 142 (1965).

² W. E. Engeler, H. Fritzsche, M. Garfinkel, and J. J. Tiemann, *Phys. Rev. Letters* **14**, 1069 (1965).

³ I. Balslev, *Phys. Letters* **24A**, 113 (1967).

⁴ I. Balslev, *Solid State Commun.* **5**, 315 (1967).

⁵ I. Balslev, *Phys. Rev.* **143**, 636 (1966).

Simple Method of Rotating Samples in Microwave Cavities at Low Temperatures

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FOR EPR measurements it is sometimes necessary to arbitrarily position a sample in a microwave cavity at low temperature with respect to the magnetic field. When the magnet has a rotating base, it is possible to rotate the magnetic field around the sample in a horizontal plane. When the crystal axes are unknown, this method is not adequate because there is still one degree of freedom left. We have therefore developed a method for rotating a sample in a vertical plane at low temperatures.

In order to cancel unwanted modes, a flattened version of a cylindrical cavity of the TE_{112} mode has been chosen. Matching is achieved by the use of a Teflon variable coupler (B), as described by Gordon.¹ In the broad sides, slots (C) have been made through which a Teflon cogwheel (D) can be driven by a brass worm-gear (E), which has been mounted outside the cavity (A).

The cog-wheel (D) drives a Teflon-shaft (F) on which the sample under investigation can be mounted (see Fig. 1). Penetration of liquid helium into the cavity is prevented by sealing the whole assembly by means of a brass pot (J), which fits very closely around the brass manifold (K). High vacuum silicon grease (Dow Corning Corp.) is used between them in order to achieve a good seal. In order to drive the wormgear-shaft outside the helium bath with-

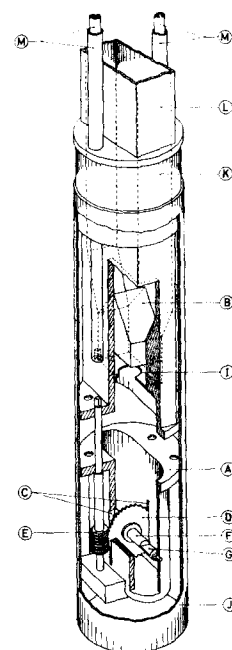


FIG. 1. Exploded view of microwave cavity assembly. A—lower part of microwave cavity; B—Teflon variable coupler; C—slots in cavity walls; D—Teflon cogwheel; E—brass wormgear; F—Teflon shaft; G—sample mount; I—iris; J—brass pot; K—brass manifold; L—waveguide; and M—stainless steel tubes.